Zero Stem Allomorphy in Consonant Gradation

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DOI: 10.56201/ijssmr.v10.no10.2024.pg1.8

Abstract

This paper studies zero stem allomorphy in consonant gradation in Fulfulde. Consonant gradation in Fulfulde involves the modification of stem-initial segments through the concatenation of suffixes in the case of nouns or a change in person and number in the case of verbs. Although Fulfulde is a language noted to exhibit a complex pattern of consonant gradation, there are stems that do not participate in this morphophonological phenomenon and they are substantial in number. These stems as characterised in this paper are equivalent to what Arnott (1970) describes as uniform stems in Fulfulde consonant gradation. Both in the literature and in the data for this study obtained from fieldwork, it is noted that Fulfulde stems with [t, l; m, n, ɲ, ŋ; ɓ, ɗ, ʄ ’] as their initial segments do not undergo gradation. Consonant gradation follows the continuant – stop – nasal pattern in many dialects of the language. Findings suggest that the absence of gradation in these stems stem from a prohibition against their continuancy in the phonotactics of Fulfulde. This paper consequently identifies the constraints militating against their continuancy from the point of view of Optimality Theory.

Keywords: *Consonant gradation, Uniform stems, Optimality Theory, Phonotactics, Continuancy*

1. Introduction

This paper discusses zero stem allomorphy in consonant gradation from the perspective of Optimality Theory (Prince & Smolensky, 1993; 2004). The paper assumes a basic understanding of the theory. Consonant gradation, also called consonant mutation is a common morphophonological process occurring in many languages of the world. It is seen by Grijzenhout (2011, p.1537) as a modification in one phonetic feature of a consonant that impacts the extent of its sonority without considering the position of the consonant within a prosodic sphere (i.e. neutralization and enhancement phenomena are excluded), nor on the position proximately adjacent to a sound with which it forms a natural class (i.e. progressive and regressive voicing and place assimilations are not regarded as instances of “consonant mutations”). More precisely, the term “consonant mutation” refers to a class of processes through which a consonant changes into “a segment with a different degree of voicing, continuancy, or nasality that is not due to neutralization or assimilation to a neighboring segment of the same natural class”.

While Fulfulde is a language that is noted for the display of consonant gradation particularly at the left edges of words, it is nonetheless observed that not all stems participate in gradation. Consequently, Arnott (1970) classifies Fulfulde stems into three with respect to gradation: *Uniform*, *Variform* and *Unchanging* stems. Uniform stems, which are the focus of this paper, are those stems that remain unchanged "in all circumstances". *Variform* stems are those that fully participate in gradation and from them are pairs including p/f, b/w, k/h, s/ʧ, d/r, g/w, g/j, ʤ/j, etc. Furthermore, there are cases where mutation is expected but it does not occur. Such cases involve the stops [p, b, d, k, g, ʧ, ʤ] referred to as *Unchanging stems* (Arnott, 1970, p.4) which participate in mutation in some contexts but not in others.

2. *Uniform* Initial Segments

The segments characterised as Uniform as stated earlier, are sounds in Fulfulde which do not participate in gradation. Since gradation is argued to be induced by [+continuant] feature, a segment that is [–continuant] but without a [+continuant] counterpart does not have a gradation correspondent. As seen in the introduction, the following sounds have these properties: [t, l; m, n, ɲ, ŋ; ɓ, ɗ, ʧ '; k' ʔ]. Interestingly, except for [t, l], each group of sounds forms a class. In what follows, these sounds are treated one after the other in order to identify the cause(s) of their behaviour with respect to consonant gradation.

2.1 The voiceless alveolar stop [t]

The voiceless alveolar stop [t] does not undergo gradation because the voiceless dental fricative [θ], its probable gradation counterpart, does not occur in Fulfulde. It is noted however, that shared voicing and place features are important in pairing sounds in the language for the purpose of gradation. The voiceless alveolar fricative [s] is therefore a possible candidate. It is observed however, that [s], is not its possible gradation partner because the two sounds differ in terms of stridency. The following constraint in (1) rules out that possibility.

(1) IDENT-IO [–STRID]

Correspondent input and output segments share identical [–strident] feature.

While [t] has the feature [–strident], [s] has the specification [+strident]. This variation makes the two sounds incompatible for gradation.

2.2 The lateral [l]

The lateral [l], is argued in this paper to pattern as [–continuant] sound in Fulfulde. The lateral is reported to exhibit "ambivalent" behaviour in many languages (Mielke, 2005). This inconsistent behaviour makes the categorisation of the lateral sound as either [–continuant] or [+continuant] controversial as vividly captured by Chomsky and Halle (1968. p. 318) cited in Mielke (2005, p.170) emphasis in original:

> The characterization of the liquid [l] in terms of the continuant–noncontinuant scale is even more complicated [than the characterization of other liquids]. If the defining characteristic of the stop is taken…as total blockage of air flow, then [l] must be viewed as a continuant and must be distinguished from [r] by the feature of 'laterality'. If, on the other hand, the defining characteristic of stops is taken to be the blockage of air flow past the primary stricture, then [l] must be included among the stops. The

phonological behavior of [l] in some languages supports somewhat the latter interpretation.

In this paper, it is argued that the lateral in Fulfulde patterns as [–continuant][1]. This classification is done on the strength of the behaviour of the sound in the language. Fulfulde, from the literature and the data collected, is a language that has a large inventory of geminate structures. However, the geminates are predominantly from stops; geminates involving the continuants are very rare. In contrast, the lateral /l/ manifests itself in many nouns and verbs as geminate – an indication that in this language, it patterns as [–continuant]. Examples are given in (2).

(2) Examples of words with geminate [l].

Nouns	**Gloss**	**Verbs**	**Gloss**
hello	pat on the back	*holli*	showed
dallol	rivulet	*dilli*	left
mellol	turban	*wulli*	cried
hottollo	cotton	*fillii*	spoke
polle	vegetable	*silli*	shat
pullo	Fula speaker	*walli*	helped
cille	excrement	*ɲalli*	spent the day
ɲallol	day	*halli*	be tough
filla	speech	*helli*	pat (someone) on back
salla	trousers	*melli*	turbaned (someone)
galluure	village	*dulli*	didn't have
bolle	snakes	*ƙullinii*	bent with butt outward
ɓalli	bodies	*ƙellii*	balanced (load) on head
gulli	navels	*jillootiri*	mixed up
gollal	work	*jillindiri*	mixed

In (3), it is shown that each [–continuant] sound in the language has a [+continuant] counterpart:

(3) Continuant vs. non-continuant sounds

Pairs	**Singular**	**IPA**	**Plural**	**IPA**	**Gloss**
p → f	*pul-lo*	[pʊl-lo]	*ful-ɓe*	[fʊl-ɓe]	Fula speaker
k → h	*kuunee-je*	[ku:ne:-ʤe]	*huunee-re*	[hu:ne:-ɾe]	cap
d→r	*debb-o*	[debb-o]	*rew-ɓe*	[rew-ɓe]	female
c → s	*col-li*	[ʧol-lɪ]	*son-du*	[son-dʊ]	bird
b → w	*baa-ɗi*	[bɑ:ɗ-ɪ]	*waan-du*	[wɑ:n-dʊ]	monkey
g → w	*gul-li*	[gʊl-lɪ]	*wud-du*	[wʊd-dʊ]	navel
j → y	*jah-e*	[ʤɑh-e]	*yaa-re*	[jɑ:ɾ-e]	scorpion
g → y	*geec-e*	[ge:ʧ-e]	*yees-o*	[je:s-o]	face
***l → l**	*leec-e*	[le:ʧ-e]	*lees-o*	[le:s-o]	bed

[1] Hayes (2009, p.78) equally observes that "In some feature systems, the partial closure (midline of vocal tract) of laterals justifies their being classified as [–continuant] …". Languages in which the lateral patterns as a stop include Basque and Wayana (van de Weijer, 1995), Blin (Fallon, 2006), Arabic (Alhjouj, 2013); and German (Wiese, 1996) etc. but for a detailed discussion of the status of the lateral in different languages, see Mielke (2005).

The foregoing examples indicate that the lateral in Fulfulde cannot bear the feature [+continuant]; hence, the constraint stated in (4).

(4) *LAT-CONT

If lateral, then not [+continuant].

2.3 **The Nasals [m, n, ɲ, ŋ]**

The third set comprises [m, n, ɲ, ŋ]. As nasals, they are not docking sites for the feature [+continuant]; hence, their non-alternating status. The constraint prohibiting the continuancy of nasal sounds is stated in (5) below.

(5) *NAS-CONT

If [nasal], then not [+continuant].

A faithfulness constraint that preserves the [nasal] feature is needed. The constraint is stated in (6).

(6) IDENT-NAS

Correspondent input and output segments share identical [nasal] features.

2.4 **Sounds produced with a constricted glottis [ɓ, ɗ, ʄ', k', ʔ]**

The next case is that of the implosives, the palato-alveolar ejective, the velar ejective and the glottal stop – [ɓ, ɗ, ʄ', k', ʔ]. They are produced with a constricted glottis; thus, like the nasals, they too are not specified for the feature [+continuant]. The constraint militating against their continuancy is given in (7).

(7) *CG-CONT

If [constricted glottis], then not [+continuant].

Again, like the lateral and the nasals, a feature-preserving constraint, stated in (8), is needed.

(8) IDENT-CG

Correspondent input and output segments share identical [constricted glottis] features.

Having seen why stems with *uniform* initial segments do not undergo mutation, the next section presents representative tableaux to show how the identified constraints handle the non-continuancy of these segments in Optimality Theory.

3. Discussion

In the preceding section, constraints militating against the Uniform stems bearing [+continuant] feature have been identified. What remains is to provide representative tableaux to show how Optimality Theory handles the constraints militating against the continuancy of this class of sounds. Recall that consonant gradation in Fulfulde targets the left edge of the stem; hence, Alignment constraint (McCarthy & Prince, 1994) is crucial in the discussion of gradation. The constraint is stated in (9).

(9) ALIGN ([+CONT], L, STEM, L).

The feature [+continuant] must be aligned at the left edge of the stem.

Since the gradation feature is argued to be [+continuant], it must be included in the input. Recall that in Optimality Theory, candidate sets are generated by the function GEN (among them will be the optimal candidate) and passed on to the function EVAL for evaluation and the selection of the best candidate favoured by the ranking of the constraints in the language. The most harmonic candidate, usually selected as optimal, is indicated on the tableau by a forward pointing hand (☞). However, where a wrong candidate is selected based on an erroneous constraint ranking, such a candidate is indicated by a backward pointing hand (☜). The Alignment constraint is simply represented in the tableau as ALIGN. Violation of high-ranking constraints counts as fatal violations and rule out the offending candidate whereas a lower-ranking constraint may be violated without serious consequences.

(10) Tableau for stem-initial [t] in *teewu* 'meat'

	/teew + u [+CONT]/	ALIGN	IDENT{-STRID}
☜	a. [seew-u]		*
	b. [teew-u]	*!	

The constraints as ranked in (10) wrongly select the sub-optimal candidate (a) because it has a continuant-initial stem and only incurs a non-fatal violation of IDENT-IO [STRID] as against the right candidate which, though satisfying IDENT-IO [STRID], fatally violates the undominated ALIGN. To get the right candidate to surface as optimal therefore, the ranking has to be reversed in a way that IDENT-IO [STRID] dominates ALIGN ([+CONT], L, STEM, L). This is done in (11).

(11) Tableau for stem-initial [t] in *teewu* 'meat'

	/teew + u [+CONT]/	IDENT{-STRID}	ALIGN
	a. [seew-u]	*!	
☞	b. [teew-u]		*

In (11), it is demonstrated that the ranking in which IDENT-IO [STRID] dominates ALIGN ([+CONT], L, STEM, L) is crucial and is the right ranking that selects the right candidate. Candidate (a) fatally violates IDENT-IO [STRID] and is thus eliminated even though it satisfies the lower-ranking ALIGN. Candidate (b) emerges the optimal candidate with a non-fatal violation of the same constraint. Examined next is the lateral [l] which is prohibited from taking

the [+continuant] feature by the constraint in (4). The constraint is included as an undominated constraint in the tableau in (12).

(12) Tableau for initial [l] in *laawol* 'road'

	/laa + wol [+CONT]/	*LAT-CONT	ALIGN
	a. [raa-wol]	*!	
☞	b. [laa-wol]		*

In (12), the constraints as ranked, select candidate (b) as the optimal candidate because even though it doesn't have a continuant-initial segment, thus violating ALIGN, the violation is a non-fatal one. This makes it a more desirable candidate than candidate (a) which incurs a fatal violation of the undominated *LAT-CONT. The non-continuancy of the nasal segments [m, n, ɲ, ŋ] is examined next in the representative tableau in (13).

(13) Tableau for nasal-initial stem *maw-ɗo* 'important person'

	/maw + ɗol [+CONT]/	*NAS-CONT	ALIGN
	a. [baw-ɗol]		*!
	b. [maw-ɗol]		*!

There is a tie in (13) because neither candidate has a continuant-initial stem; hence, they are equal on both constraints. This outcome necessitates the introduction of another constraint, a faithfulness one that will preserve the nasal feature. The constraint, stated in (6) is incorporated into the ranking in the tableau in (14).

(14) Tableau for nasal-initial stem *maw-ɗo* 'important person'

	/maw + ɗol [+CONT]/	*NAS-CONT	IDENT-NAS	ALIGN
	a. [baw-ɗol]		*!	*
☞	b. [maw-ɗol]			*

The introduction of an additional constraint that seeks to preserve the feature [nasal] in the constraint ranking in (14) is effective because it has removed the sub-optimal candidate (a) which fatally violates it. The optimal candidate (b) satisfies this constraint and is selected with a non-fatal violation of ALIGN. Considered next are the sounds produced with a constricted glottis. These sounds are [ɓ, ɗ, ʄ', k', ʔ] and a representative tableau is provided in (15).

(15) Tableau for *ɓow-ngu* 'mosquito'

	/ɓow-ngu/ [+CONT]/	ALIGN	*CG-CONT
☜	a. [wow-ngu]		*
	b. [ɓow-ngu]	*!	

The ranking in (15) in which ALIGN dominates *CG-CONT does not produce the desired result because the non-harmonic candidate (a) is selected by the ranking. It satisfies the undominated ALIGN but suffers a non-fatal violation of *CG-CONT. the harmonic candidate (b) on the other hand, fatally violates ALIGN and is eliminated although it satisfies *CG-CONT. A reversal of ranking, as done in (16) with an additional constraint that preserves that feature [Constricted Glottis] will ensure that the attested candidate wins.

(16) Tableau for *ɓow-ngu* 'mosquito'

	/ɓow-ngu/ [+CONT]/	*CG-CONT	IDENT-CG	ALIGN
	a. [wow-ngu]		*!	
☞	b. [ɓow-ngu]			*

In (16), the desired result is achieved because the more harmonic candidate (b) is selected as the optimal candidate with a non-fatal violation of ALIGN. Candidate (a) fatally violates the faithfulness constraint which eliminated it.

4. Conclusion

The analysis of consonant gradation in Fulfulde shows that in gradation, there is an interplay of *markedness* and *faithfulness* constraints. It is however noted that even though the Alignment constraint is crucial for gradation because the [+continuant] gradation feature is always aligned to the left edge of the stem, for stems that do not participate in gradation as discussed in this paper, the Alignment constraint must be dominated. The constraints IDENT-[-STRID], *LAT-CONT, *NAS-CONT, IDENT-NAS, *CG-CONT and IDENT-CG explain why such stems do not participate in consonant gradation.

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